# Operating Instructions
# Non-Contact Safety Switch with Guard Locking
# CET.-AP-... (from V 1.5.0)

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# Scope

These operating instructions are valid for all CET.-AP-... from version V 1.5.0. These operating instructions and the enclosed data sheet form the complete user information for your device.

# Correct use

The safety switch CET-AP is an electromagnetic interlocking device with guard locking.

In combination with a safety guard and the machine control, this safety component prevents the safety guard from being opened while a dangerous machine movement is being performed.

For the control system, this means that

- starting commands which cause hazardous situations must become active only when the safety guard is in protective position and the guard locking is in locked position. The locked position of the guard locking must be released only when the hazardous situation is no longer present.

Before safety components are used, a risk assessment must be performed on the machine in accordance with

- EN ISO 13849-1, Safety of machinery. Safety related parts of control systems. General principles for design, Annex B
- EN ISO 12100, Safety of machinery - General principles for design - Risk assessment and risk reduction
- IEC 62061, Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

Correct use includes compliance with the relevant requirements for installation and operation, in particular

- EN ISO 13849-1, Safety of machinery. Safety related parts of control systems. General principles for design
- EN 1088, Safety of machinery. Interlocking devices associated with guards. Principles for design and selection
- EN 60204-1, Electrical equipment of machines

The safety switch is only allowed to be operated in conjunction with the intended EUCHNER CET actuators and the related connection components from EUCHNER. On the use of different actuators or other connection components, EUCHNER provides no warranty for safe function.

**Important!**

- The user is responsible for the integration of the device into a safe overall system. For this purpose, the overall system must be validated, e.g. in accordance with EN ISO 13849-2.
- Correct use requires observing the permissible operating parameters (see Technical data).
- If a product data sheet is included with the product, the information on the data sheet applies in case of discrepancies with the operating instructions.
- It is only allowed to use components that are permissible in accordance with the table below.

## Possible combinations for CES components

| Safety switches | Actuator |
|---|---|
| | **CET-A-BWK-50X**<br>096327 |
| **CET.-AP-...** | ● |

| | | |
|---|---|---|
| **Key to symbols** | ● | Combination possible |

# Exclusion of liability and warranty

In case of failure to comply with the conditions for correct use stated above, or if the safety instructions are not followed, or if any servicing is not performed as required, liability will be excluded and the warranty void.

# General safety instructions

Safety switches fulfill personal protection functions. Incorrect installation or tampering can lead to fatal injuries to personnel.

For the multicode version the following applies: as the unique actuator codes are not evaluated, the CET.-AP-...-CH-... version can only be used for applications in which a hazard cannot result from possible tampering with the system.

Check the safe function of the safety guard particularly

- after any setup work
- after the replacement of a CET component
- after an extended period without use
- after every fault

Independent of these checks, the safe function of the safety guard should be checked at suitable intervals as part of the maintenance schedule.

**Warning!**

Danger of fatal injury in the event of incorrect connection or incorrect use.
- Safety switches must not be bypassed (bridging of contacts), turned away, removed or otherwise rendered ineffective. On this topic pay attention in particular to the measures for reducing the possibility of bypassing from EN 1088:1995+A2:2008, Section 5.7.

The device is only allowed to be installed and placed in operation by authorized personnel
- who are familiar with the correct handling of safety components
- who are familiar with the applicable EMC regulations
- who are familiar with the applicable regulations on health and safety and accident prevention
- who have read and understood the operating instructions.

**Important!**

Prior to use, read the operating instructions and keep these in a safe place. Ensure that the operating instructions are always available during mounting, setup and servicing. EUCHNER cannot provide any warranty in relation to the readability of the CD for the storage period required. For this reason you should archive a printed copy of the operating instructions. You can download the operating instructions from www.EUCHNER.de.

# Function

## Function of the electronics

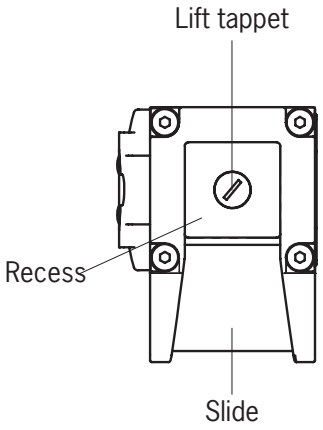
Safety switches series CET-AP permit locking of movable safety guards. They meet the following safety requirements:

- Category 3, PLe according to EN ISO 13849-1 (head mounted upward)
- Category 4, PLe according to EN ISO 13849-1 (head mounted downward or horizontal)
- Redundant design of the circuit in the unit with self-monitoring
- This means that the safety system still functions even if an internal component fails
- The switch state of the semiconductor outputs is continuously monitored internally
- Short circuit detection at the safety outputs by pulsed signals

The following switch-on condition applies to safety outputs OA and OB (see also *System status table* and the section *Typical system times*):

- Safety guard closed
- Guard locking active (actuator completely inserted into recess)
- Feedback loop closed (only for version with feedback loop/start button)

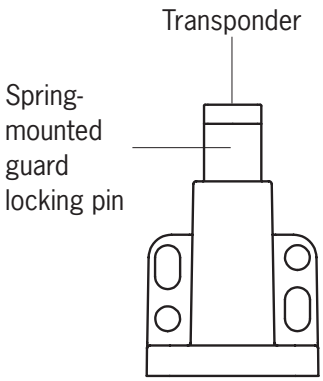
The system consists of the following components: coded actuator (transponder) and switch.




Each actuator has a unique electronic coding and is therefore a unique element. The code in an actuator cannot be reprogrammed.

**For the unicode version the following applies:**
The actuator must be assigned to the safety switch by a teach-in operation so that it is detected by the system. This unambiguous assignment ensures a particularly high level of protection against tampering.

**For the multicode version the following applies:**
Unlike systems with unique code detection, on multicode devices a specific code is not polled but instead it is only checked whether the actuator is of a type that can be detected by the system (multicode detection).
There is no exact comparison of the actuator code with the code defined in the safety switch (unique code detection).




The safety switch with integrated evaluation unit and read head is fastened to the fixed part of the safety guard.

The actuator attached to the movable part of the safety guard is moved towards the read head fitted in the safety switch by closing the door. When the switch-on distance is reached, power is supplied to the actuator by the inductive read head and data can be transferred.

The bit pattern read is compared with the code saved in the safety switch. If the data match, the safety outputs are enabled. On devices with monitoring output (OUT), this is also switched off.

Due to the combination of dynamic polling of the actuator and the redundant, diverse design of the safety electronics with the two feedback safety outputs, the safety switch will enter the safe state with every detectable fault.

The safety outputs shut down the safety circuit if the safety guard is opened. On devices with monitoring output (OUT), this is switched on. The state of the safety outputs is monitored internally by two microprocessors.

In the event of a fault in the safety switch, the safety circuit is switched off and the DIA LED illuminates red.

The safety switch has a redundant circuit design with self-monitoring. This means that the safety system is still effective even if a component fails.

The system is designed so that failures will not result in the loss of the safety function. The occurrence of failures is detected by cyclic self-monitoring at the latest on the next demand to close the safety contacts (e.g. on starting).

## Function of the guard locking

### Version CET1-AP, guard locking by spring force

The lift tappet is pressed into the locked position by the force of the spring for the guard locking pin in the actuator and unlocked electromagnetically by the safety switch. The guard locking functions in accordance with the closed-circuit current principle. The locked safety guard cannot be opened immediately in the event of interruption of the power supply to the solenoid.

The guard locking pin of the actuator cannot be moved out of the recess and the door is locked in the closed position as long as the lift tappet is pressed down by the actuator.

When the operating voltage is present at the guard locking solenoid, the lift tappet is extended and lifts the actuator's guard locking pin above the edge of the recess. The safety door can then be opened.

### Version CET2-AP, guard locking by solenoid force

**Important!**

The safety guard can be opened immediately in the event of interruption of the solenoid power supply! This type may be used only in special cases after strict assessment of the accident risk (see DIN EN 1088 (1995), section 5.5)!
Example: If the risk of accidental locking inside a safety guard during a power failure is higher than the risk of ineffective guard locking.

The lift tappet is held in locked position by electromagnetic force and released by spring force. The guard locking operates in accordance with the open-circuit current principle.

The safety door can be opened as long as the lift tappet is held in the extended position.

The lift tappet is released when operating voltage is present at the guard locking solenoid. The actuator's guard locking pin can now press the lift tappet down. The safety door is locked as soon as the guard locking pin is fully inserted into the recess.

### Version CET3-AP, guard locking by spring force with door monitoring output

Function as for CET1-AP, but the door position is also monitored here. The door monitoring output OUT D is switched on as soon as the actuator protrudes beyond the extended lift tappet (state: door closed, guard locking not active). The output OUT D also remains switched on when guard locking is active.

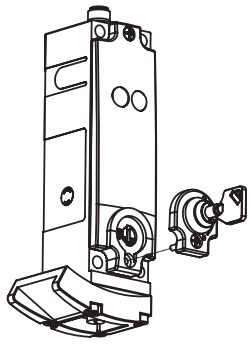
Devices for connection to decentralized peripheral systems do not feature a door monitoring output OUT D. Instead, the door position is indicated via LED 2.

### Version CET4-AP, guard locking by solenoid force with door monitoring output

Function as for CET2-AP, but the door position is also monitored here. The door monitoring output OUT D is switched on as soon as the actuator protrudes beyond the extended lift tappet (state: door closed, guard locking not active). The output OUT D also remains switched on when guard locking is active.

Devices for connection to decentralized peripheral systems do not feature a door monitoring output OUT D. Instead, the door position is indicated via LED 2.

## Mechanical release and mechanical key release (can be retrofitted)



**Important!**

- The mechanical release is not a safety function.
- The machine manufacturer must select and use a suitable release (escape release, emergency unlocking, etc.) for a specific application. A risk assessment appraisal is required for this purpose. It may be necessary to take specifications from a product standard into account.
- The mechanical key release must not be used to lock the switch during servicing to prevent activation of guard locking, for example.
- The correct function must be checked at regular intervals.
- Loss of the release function due to mounting errors or damage during mounting.
- Check the release function every time after mounting.
- Loss of the release function due to tension on the actuator. The door must not be under tension during release.
- Please observe the notes on any enclosed data sheets.

The mechanical release can be used to unlock guard locking, irrespective of the state of the solenoid.

**Using mechanical release**

1. Unscrew locking screw
2. Using a screwdriver, turn the mechanical release by around 180° in the direction of the arrow

➡ The safety guard can be opened

The mechanical release must be returned to its original position and sealed after use (for example with sealing lacquer).

**Using mechanical key release**

On devices with mechanical key release (can be retrofitted), simply turn the key to unlock. For mounting, see the mechanical key release supplement.

On devices with monitoring output OUT, this is switched off; OUT D can assume an undefined state. Open the safety door and close it again after resetting the mechanical release. The device will then operate normally again.

## Emergency unlocking (can be retrofitted)

**Important!**

- Emergency unlocking is not a safety function.
- The machine manufacturer must select and use a suitable release (escape release, emergency unlocking, etc.) for a specific application. A risk assessment appraisal is required for this purpose. It may be necessary to take specifications from a product standard into account.
- The correct function must be checked at regular intervals.
- Loss of the release function due to mounting errors or damage during mounting.
- Check the release function every time after mounting.
- Loss of the release function due to tension on the actuator. The door must not be under tension during release.
- Please observe the notes on any enclosed data sheets.

Emergency unlocking can be used to unlock guard locking, irrespective of the state of the solenoid. For mounting, see the mounting supplement.

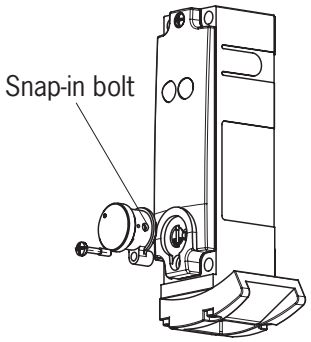
### Using emergency unlocking

**Important!**

The door must not be under tension when emergency unlocking is actuated.

- Turn emergency unlocking clockwise until it clicks into place.

➡ The safety guard can be opened

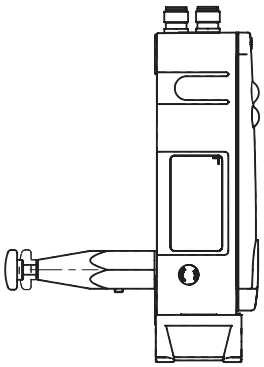



To reset, press the snap-in bolt inward using a small screwdriver or similar tool and turn the emergency unlocking back.

On devices with monitoring output OUT, this is switched off; OUT D can assume an undefined state. Open the safety door and close it again after resetting emergency unlocking. The device will then operate normally again.

## Escape release (optional)

**Important!**



- The escape release is not a safety function.
- The machine manufacturer must select and use a suitable release (escape release, emergency unlocking, etc.) for a specific application. A risk assessment appraisal is required for this purpose. It may be necessary to take specifications from a product standard into account.
- The correct function must be checked at regular intervals.
- Loss of the release function due to tension on the actuator. The door must not be under tension during release.
- Please observe the notes on any enclosed data sheets.

The escape release is used to open a locked safety guard from the inside (see *dimension drawing* in the section *Technical data*).

Fit escape release such that operation, inspection and service are possible.

### Using the escape release

- Press the red release knob to the stop

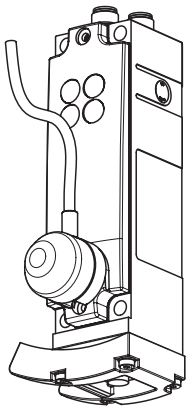
➡ The safety guard can be opened

Pull the knob out again to reset.

On devices with monitoring output OUT, this is switched off; OUT D can assume an undefined state. Open the safety door and close it again after resetting the escape release. The device will then operate normally again.

## Wire front release (optional)

**Important!**



- The wire front release is not a safety function.
- The wire front release is non-latching and therefore must not be used as an escape release unless the machine manufacturer itself provides a detent mechanism. The machine manufacturer must select and use a suitable release (escape release, emergency unlocking, etc.) for a specific application. A risk assessment appraisal is required for this purpose. It may be necessary to take specifications from a product standard into account.
- Loss of the release function due to tension on the actuator. The door must not be under tension during release.
- The correct function must be checked at regular intervals.

The wire front release permits remote release of the guard locking via a pull wire. Flexible routing of the pull wire permits release of the guard locking in inaccessible installation situations.

On devices with monitoring output OUT, this is switched off; OUT D can assume an undefined state. Open the safety door and close it again after resetting the wire front release. The device will then operate normally again.

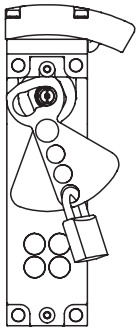
### Mounting the wire front release

**Important!**

- Loss of the release function due to mounting errors, damage or wear.
- Check the release function every time after mounting.
- When routing the wire front release, ensure that it operates smoothly.
- Observe the min. bending radius (100 mm) and minimize the number of bends.
- The switch is not allowed to be opened.
- Observe the notes on the enclosed data sheets.

## Lockout mechanism (optional)

**Important!**



- The lockout mechanism is not a safety function.
- The correct function must be checked at regular intervals.

The lockout mechanism can be used to prevent maintenance personnel from being unintentionally locked in the danger area, for example.

In locked position, the lockout mechanism prevents activation of guard locking. The lockout mechanism can be secured in locked position with up to three locks. The mechanical release can still be used.

### Using the lockout mechanism

**Important!**

Deactivate guard locking and open the safety door before using the lockout mechanism.

Before entering the danger area:

1. Open the door
2. Press button, move lockout mechanism to locked position (Figures A and B) and secure with lock (Figure C)

➡ Guard locking cannot be activated, and it must not be possible to start the machine. Important: Test this before entering the danger area!

Resetting the lockout mechanism:

1. Open the safety door if necessary
2. Remove the lock
3. Move lockout mechanism to basic position (Figure A)

Locking function not active

Pushbutton

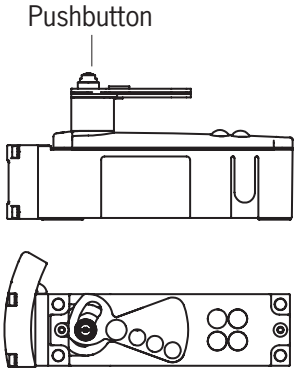


Figure A

Locking function active

Push button and align lever

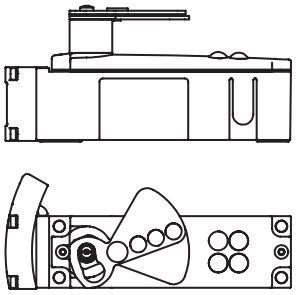


Figure B

Locking function active and secured

Fit lock

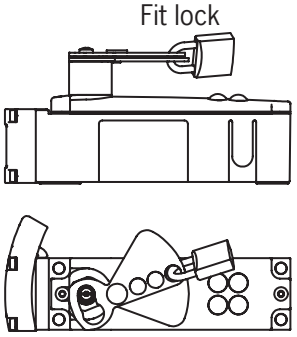
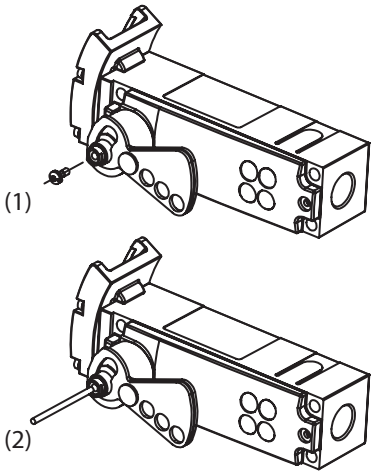


Figure C




**Using mechanical release**

1. Unscrew locking screw
2. Operate the mechanical release through the tapped hole for the locking screw (e.g. with a metal rod ∅ 3 mm)

➡ The safety guard can be opened

The locking screw must be screwed back in and sealed after use (for example with sealing lacquer).

On devices with monitoring output OUT, this is switched off; OUT D can assume an undefined state. Open the safety door and close it again after resetting the mechanical release. The device will then operate normally again.

# Changing the approach direction

1. Remove the screws from the safety switch
2. Set the required direction
3. Tighten the screws with a torque of 1.5 Nm.

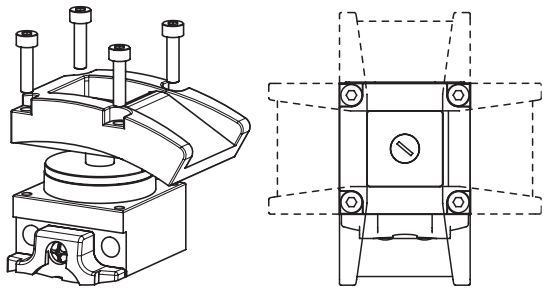


*Figure 1: Changing the approach direction*

# Mounting

**Caution!**

Safety switches must not be bypassed (bridging of contacts), turned away, removed or otherwise rendered ineffective.

- On this topic pay attention in particular to the measures for reducing the possibility of bypassing according to EN 1088:1995.A2:2008, sec. 5.7.
- The max. achievable category according to EN 13849-1 depends on the installation position (see technical data).

**Caution!**

Risk of damage to equipment and malfunctions as a result of incorrect installation.

- Safety switches must not be used as a mechanical end stop. Fit an additional end stop for the movable part of the safety guard.
- Observe the min. door radii (see figure below).
- Ensure that the actuator contacts the slide in the designated area (see figure below). Marks on the slide specify the prescribed approach zone.
- The prerequisite for trouble-free long-term operation is protection of the switch head against penetrating foreign objects such as swarf, sand, and blasting shot, etc. The switch should be installed with the actuating head down for this purpose.
- Cover the switch before painting work.

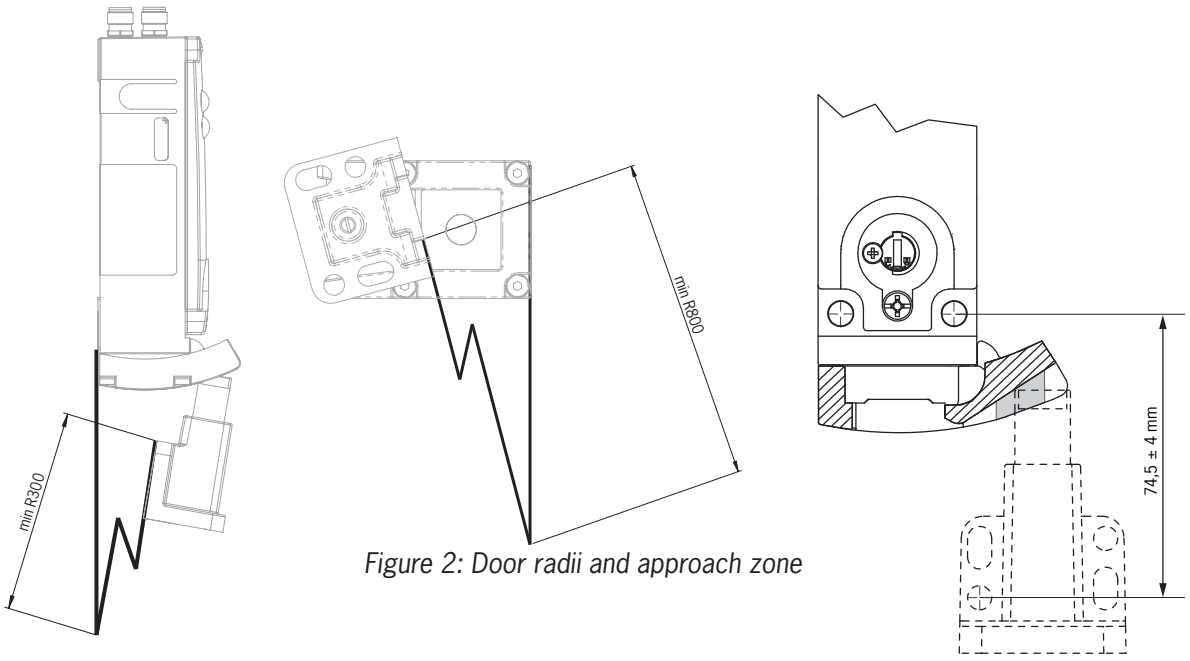
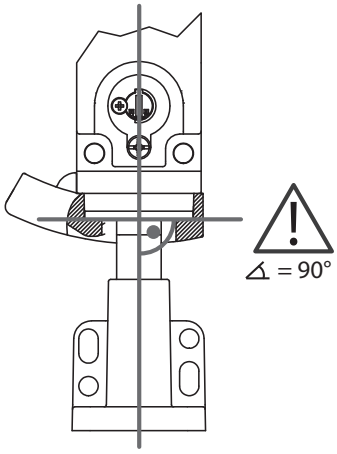
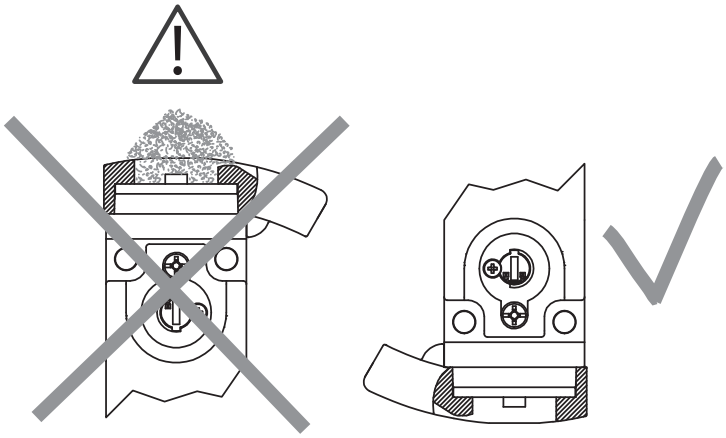



*Figure 2: Door radii and approach zone*




Note the following points:

- Actuator and safety switch must be easily accessible for inspection and replacement.
- The switching operation must only be triggered by the specific actuator designated for this purpose.
- Actuator and safety switch must be fitted so that
  - the actuator is positively mounted on the safety guard, e.g. by using the safety screws included.
  - they cannot be removed or tampered with using simple means.
  - the active faces of the actuator and the safety switch are parallel to each other (see figure on the left).
  - the actuator is fully inserted into the switch recess when the safety guard is closed (see figure on the left).
  - no dirt can accumulate in the recess.



# Electrical connection

**Warning!**

In case of an error, loss of the safety function through incorrect connection.
- To ensure safety, both safety outputs (OA and OB) must always be evaluated.
- The monitoring output OUT and the door monitoring output OUT D are not allowed to be used as safety outputs.
- Lay the connection cables with protection to prevent the risk of short circuits.

**Caution!**

Risk of damage to equipment or malfunctions as a result of incorrect connection.
- The power supply for the evaluation electronics is electrically isolated from the power supply for the guard locking solenoid.
- The teach-in input and feedback loop, as well as LED 1 and LED 2 (this is applicable only to freely controllable LEDs) have the ground potential 0 V $U_B$.
- The device generates its own clock signal on the output lines OA/OB. A downstream control system must tolerate these test pulses, which may have a duration of up to 0.3 ms.
  The test pulses are only output if the safety outputs switched on.
  Depending on the inertia of the connected device (control system, relay, etc.), this can lead to short switching processes.
- The inputs on an evaluation unit connected must be positive-switching, as the two outputs on the safety switch deliver a level of +24 V in the switched-on state.
- All the electrical connections must either be isolated from the mains supply by a safety transformer according to IEC 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures (PELV).
- The device tolerates voltage interruptions in the operating voltage ($U_B$ and $U_{CM}$) of up to 5 ms. Voltage interruptions are also output on the safety and monitoring outputs.
- For use and operation as per the cULus requirements, a power supply with the feature "for use in class 2 circuits" must be used. The same requirement applies to the safety outputs.
  Alternative solutions must comply with the following requirements:
  a) Electrically isolated power supply unit with a max. open-circuit voltage of 30 V/DC and a limited current of max. 8 A.
  b) Electrically isolated power supply unit in combination with fuse as per UL248. This fuse should be designed for max. 3.3 A and should be integrated into the 30 V DC voltage section.
- For use and applications as per the cULus requirements, a connection cable listed under UL category code CYJV/7 must be used and the following requirements met: min. 30 V DC, 2 A, 85 °C. The EUCHNER connection cables meet these requirements.
- In order to avoid EMC interference, the physical environmental and operating conditions at the installation site of the device must comply with the requirements according to the standard EN 60204-1:2006, section 4.4.2 (EMC).
- All electrical outputs must have an adequate protective circuit for inductive loads. The outputs must be protected with a free-wheeling diode for this purpose. RC interference suppression units must not be used.

**Caution!**

- Power devices which are a powerful source of interference must be installed in a separate location away from the input and output circuits for signal processing. The cable routing for safety circuits should be as far away as possible from the cables of the power circuits.
- Please pay attention to any interference fields in case of devices such as frequency converters or induction heating systems. Observe the EMC instructions in the manuals from the respective manufacturer.

**Important!**

If the device does not appear to function when operating voltage is applied (e.g. green STATE LED does not flash), the safety switch must be returned unopened to the manufacturer.

## Notes on operation with safe control systems

Please observe the following requirements for connection to safe control systems:

- Use a common power supply for the control system and the connected safety switches.
- If the operating voltage is connected to a terminal of a safe control system, this output must provide sufficient electrical current.
- Outputs OA and OB can be connected to the safe inputs of a control system. Prerequisite: The input must be suitable for pulsed safety signals (OSSD signals, e.g. from light curtains). The control system must tolerate clock pulses on the input signals. This normally can be set up by parameter assignment in the control system. Observe the notes of the control system manufacturer. For the pulse duration of your safety switch, please refer to the section *Typical system times on page 30*.

A detailed example of connecting and setting the parameters of the control system is available for many devices at www.euchner.de in the area Download » Applications » CET. The features of the respective device are dealt with there in greater detail.

## Devices for direct connection to IP65 field modules

The version CET.-AP-...-SI-... (wiring diagram A) is optimized for connection to decentralized peripheral systems, such as the ET200pro series from Siemens. The devices are parameterized and connected like an OSSD (e.g. like light curtains).

The two 5-pin M12 plug connectors can be connected directly to the sockets of an IP65 field module (e.g. ET200pro). If flying leads are used, connection to IP20 input and output modules (e.g. ET200s) is naturally also possible.

**Important!**

Observe the following notes prior to connection:
- Use only CET-AP versions that are intended to be used for this purpose.
- Parameter assignment must be performed for the input/output modules (see application example at www.EUCHNER.de, in the area Download » Applications » CET).
- Additionally observe notes from the control system manufacturer where necessary.

## Safety in case of faults

- The operating voltage $U_B$ and the solenoid voltage $U_{CM}$ are reverse polarity protected.
- The contacts OA/OB are short circuit proof.
- A short circuit between OA and OB is detected by the switch.
- A short circuit in the cable can be excluded by laying the cable with protection.

## Fuse protection for power supply

The power supply must be provided with fuse protection depending on the current required for the outputs. The following rules apply:

**Max. current consumption $I_{max}$**

$I_{max}$ = $I_{UB}$ + $I_{OUT}$* + $I_{OA+OB}$ (+ $I_{OUT\,D}$*)

$I_{UB}$ = Switch operating current (80 mA)

$I_{OUT}$ = Load current of monitoring outputs (max. 50 mA per monitoring output)

$I_{OA+OB}$ = Load current of safety outputs OA + OB (2 x max. 200 mA)

* Only on devices with the corresponding monitoring output

## Requirements for connection cables

**Caution!**

Risk of damage to equipment or malfunctions as a result of incorrect connection cables.

- Use connection components and connection cables from EUCHNER
- On the usage of other connection components, the requirements in the following table apply. EUCHNER provides no warranty for safe function in case of failure to comply with these requirements.

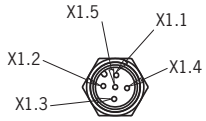
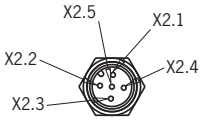
Observe the following requirements with respect to the connection cables:

**For safety switch CET-AP with plug connectors 2 x M12**

| Parameter | Value | Unit |
|---|---|---|
| Conductor cross-section min. | 0.34 | $mm^2$ |
| R max. | 60 | Ω/km |
| C max. | 120 | nF/km |
| L max. | 0.65 | mH/km |
| Recommended cable type | LIYY 8x or 5x 0.34 $mm^2$ | |

## Connector assignment safety switch CET-AP for connection to decentralized peripheral systems (2 x M12, 5-pin, pin 5 not used)

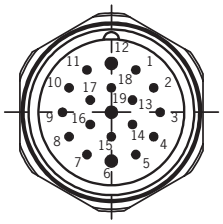
**Wiring diagram A**

| Plug connector (view of connection side) | Pin | Designation | Function | Wire color of connection cable [1] |
|---|---|---|---|---|
| 2 x M12 | X 1.1 | $U_B$ | Operating voltage, 24 V DC | BN |
|  | X 1.2 | OA | Safety output, channel 1 | WH |
| | X 1.3 | 0V | Operating voltage, 0 V | BU |
| | X 1.4 | OB | Safety output, channel 2 | BK |
| | X 1.5 | - | n.c. | GY |
|  | X 2.1 | - | n.c. | BN |
| | X 2.2 | - | n.c. | WH |
| | X 2.3 | 0V UCM | 0V solenoid | BU |
| | X 2.4 | UCM | Operating voltage of guard locking solenoid, 24 V DC | BK |
| | X 2.5 | - | n.c. | GY |

1) Only for standard EUCHNER connection cable

## Connector assignment safety switch CET-AP (1 x RC18, 19-pin)

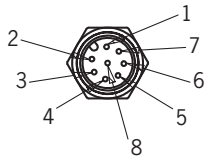
**Wiring diagram B**

| Plug connector (view of connection side) | Pin | Designation | Function | Wire color of connection cable [1] |
|---|---|---|---|---|
| 1 x RC18 | 1 | UCM | Operating voltage of guard locking solenoid, 24 V DC | VT |
|  | 2 | - | n.c. | - |
| | 3 | - | n.c. | - |
| | 4 | OA | Safety output, channel 1 | RDBU |
| | 5 | OB | Safety output, channel 2 | GN |
| | 6 | $U_B$ | Operating voltage, 24 V DC | BU |
| | 7 | RST | Reset | GYRD |
| | 8 | OUT D | Door monitoring output | WHGN |
| | 9 | - | n.c. | - |
| | 10 | OUT | Monitoring output | WHGY |
| | 11 | - | n.c. | - |
| | 12 | ⏚ | Function earth | YEGN |
| | 13 | J | Teach-in input | PK |
| | 14 | - | n.c. Do not connect to 0 V! | - |
| | 15 | - | n.c. | BNGN |
| | 16 | - | n.c. | YEBN |
| | 17 | - | n.c. | - |
| | 18 | 0V UCM | 0V solenoid | YE |
| | 19 | 0 V UB | Operating voltage, 0 V | BN |

1) Only for standard EUCHNER connection cable

## Connector assignment safety switch CET-AP (1 x M12, 8-pin)

**Wiring diagram C**

| Plug connector (view of connection side) | Pin | Designation | Function | Wire color of connection cable [1] |
|---|---|---|---|---|
| 1 x M12   | 1 | UCM | Operating voltage of guard locking solenoid, 24 V DC | WH |
| | 2 | $U_B$ | Operating voltage, 24 V DC | BN |
| | 3 | OA | Safety output, channel 1 | GN |
| | 4 | OB | Safety output, channel 2 | YE |
| | 5 | OUT/DIA | Monitoring output | GY |
| | 6 | OUT D | Door monitoring output | PK |
| | 7 | 0 V UB | Operating voltage, 0 V | BU |
| | 8 | 0V UCM | 0V solenoid | RD |

1) Only for standard EUCHNER connection cable

## Connecting the CET-AP (general)

Connect the device as shown in Figure 3. The monitoring output OUT and, if available, the door monitoring output OUT D can be connected to a control system.

The switches can be reset via the RST input. To do this, a voltage of 24 V is applied to the RST input for at least 3 seconds. If input RST is not used in your application, it should be connected to 0 V.

**Warning!**

In case of an error, loss of the safety function through incorrect connection.

- To ensure safety, both safety outputs (OA and OB) must always be evaluated. Single-channel use of the safety outputs leads to a loss of the category in accordance with EN ISO 13849-1.

**Important!**

The subsystem CET-AP complies with PL e in accordance with EN 13849-1. To integrate the subsystem in a category 3 or 4 structure, it is necessary to monitor the downstream load (the feedback loop must be monitored).
These examples show only an excerpt that is relevant for connection of the CET system. The example illustrated here does not show complete system planning. The user is responsible for safe integration in the overall system.

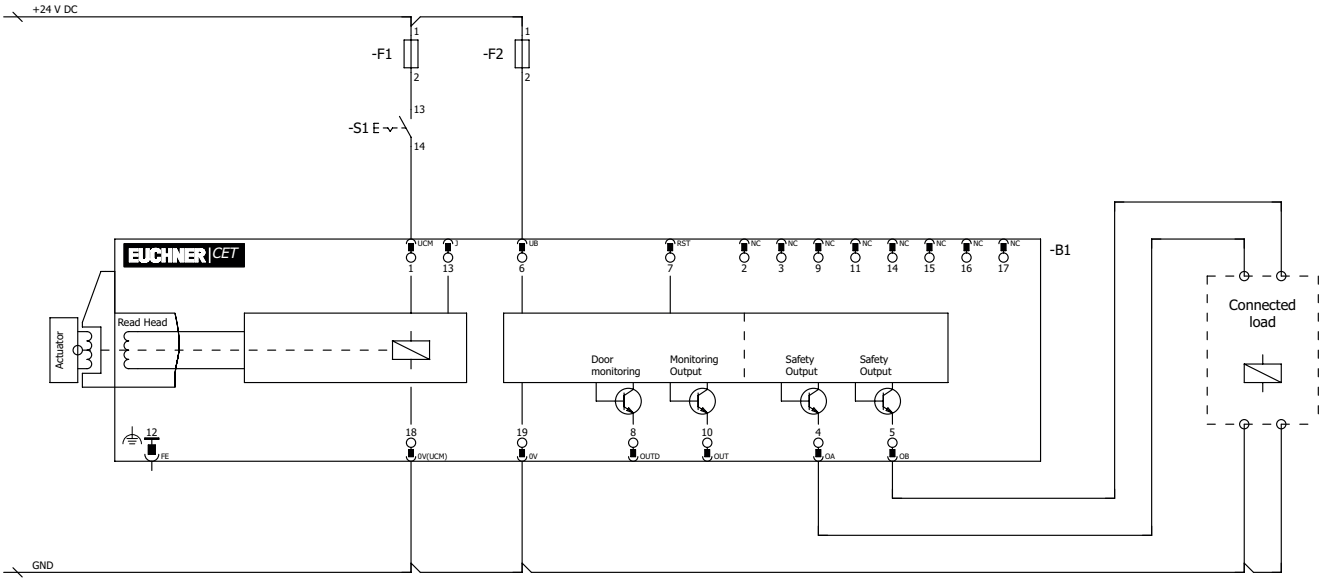



*Figure 3: Connection example for version with teach-in input and plug connector RC18*

## Connecting a CET-AP to a decentralized peripheral system (e.g. ET200 series from Siemens)

Please observe the notes in section Devices for direct connection to IP65 field modules on page 19 before connecting the device.

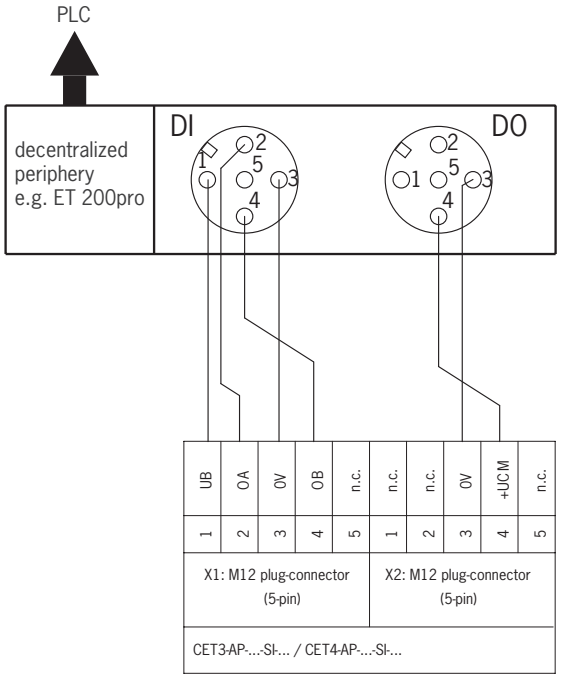



*Figure 4: Connection example for version for connection to decentralized peripheral systems (here: ET200pro)*

# Setup

## LED indicators

| LED | Color | State | Significance |
|---|---|---|---|
| **STATE** | green | illuminated | Normal operation |
| | | flashing | Teach-in operation or Power Up (for further signal function see status table) |
| **DIA** | Red | illuminated | - Internal electronics fault<br>- Fault at the inputs/outputs |
| **LED 1** | Red | Solenoid status | |
| **LED 2** | green | Door position status | |

*) Can vary depending on version. See data sheet.

## Teach-in function for actuator (only for CET unicode)

The actuator must be allocated to the safety switch using a teach-in function before the system forms a functional unit.

During a teach-in operation, the safety outputs and the monitoring output OUT are switched off, i.e. the system is in the safe state.

Depending on the version, the teach-in operation is automatic or is undertaken with the aid of the teach-in input J.

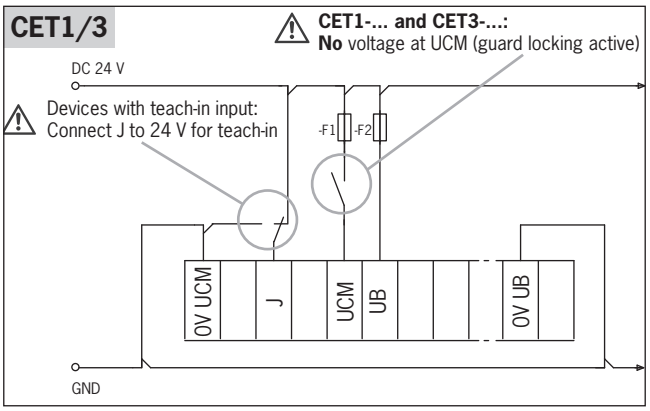
**Important!**

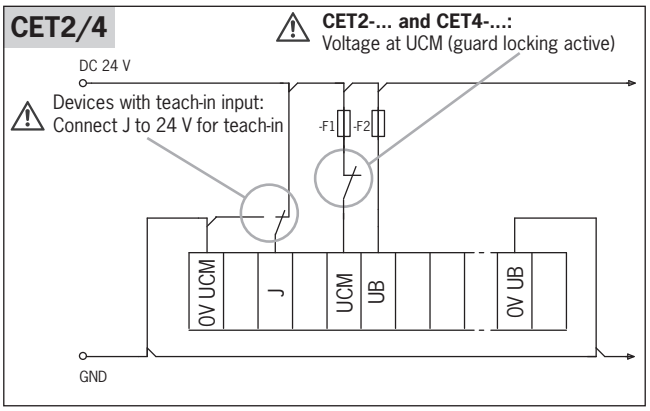
- The switch must be fully connected as described in the section *Electrical connection* to be able to use the following functions.
- In case of version with teach-in input: for the teach-in standby state, the teach-in input J must be connected to +24 V DC (see Figures 3, 4 and 5). In normal operation connect the teach-in input to 0 V.
- The safety switch disables the code of the previous actuator if teach-in is carried out for a new actuator. Teach-in is not possible again immediately for this actuator if a new teach-in operation is carried out. The disabled code is released again in the safety switch only after a third code has been taught.
- The safety switch can only be operated with the last actuator taught.
- If the switch detects the actuator that was most recently taught when in teach-in standby state, this state is ended immediately and the switch changes to normal state.
- In case of versions with teach-in input: teach-in standby state ends when the power supply to the teach-in input is interrupted.
- The actuator being taught is not activated if it is within the operating distance for less than 60 s.

## Preparing device for teach-in operation

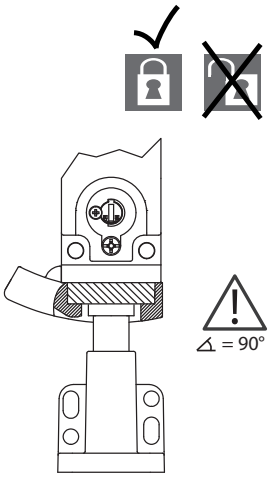
- Connect the switch as shown below, but do not apply any voltage to UB yet.
  **In case of version with teach-in input:** For the teach-in standby state, the teach-in input J must be reconnected from 0V to +24 V DC. Important: In normal operation reconnect the teach-in input to 0 V.
  **In case of version without teach-in input:** The circuit is the same, but connection J is omitted.

  Observe different control of guard locking for CET1/3 and CET2/4.




## Actuator teach-in




1. Switch on operating voltage UB.

➡ The green LED flashes cyclically three times and signals that it is in the standby state for teach-in. Standby state for teach-in remains active for approx. 3 minutes.

➡ If the red LED is illuminated, there is a fault. Teach-in is not possible. The green LED indicates the fault code. Diagnostics, see section System status table on page 28.

2. Activate guard locking.
   **CET1/3:** no voltage at UCM.
   **CET2/4:** Voltage at UCM.
3. Fully insert new actuator into the recess. Do not cant it; place it in the center of the recess (see picture on left).

➡ Teach-in operation starts, green LED flashes (approx. 1 Hz). The teach-in operation is completed after approx. 60 seconds and all LEDs go out.

4. Switch off operating voltage UB (min. 3 seconds).

➡ The code of the actuator that was just taught in is activated in the safety switch.

5. In case of version with teach-in input: connect teach-in input to 0 V.
6. Switch on operating voltage UB.

➡ The device operates normally.

# Functional check

**Warning!**

Danger of fatal injury as a result of faults in installation and functional check.
- Before carrying out the functional check, make sure that there are no persons in the danger area.
- Observe the valid accident prevention regulations.

## Mechanical function test

The actuator must slide easily into the recess on the actuating head. Close the safety guard several times to check the function.

## Electrical function test

After installation and any fault, the safety function must be fully checked. Proceed as follows:

1. Switch on operating voltage.

➡ The machine must not start automatically.

➡ The green STATE LED flashes at regular intervals.

2. Close all safety guards. Guard locking by solenoid force: activate guard locking.

➡ The machine must not start automatically. It must not be possible to open the safety guard

➡ The green STATE LED illuminates continuously.

3. Enable operation in the control system.

➡ It must not be possible to deactivate the guard locking as long as operation is enabled.

4. Disable operation in the control system and deactivate guard locking.

➡ The safety guard must remain locked until there is no longer any risk of injury.

➡ It must not be possible to start the machine as long as the guard locking is deactivated.

Repeat steps 2-4 for each safety guard.

# System status table

| Operating mode | Actuator/door position | Safety outputs OA and OB | Monitoring output OUT | Door monitoring output OUT D (only CET3 and CET4) | LED indicator, output STATE (green) | LED indicator, output DIA (red) | State |
|---|---|---|---|---|---|---|---|
| **Normal operation** | closed | on | on | on | ✳ | ○ | Normal operation, door closed and locked |
| | closed | off | on | on | ✳ 1 x inverse | ○ | Normal operation, door closed and locked, safety outputs not switched because:<br>- Feedback loop not closed |
| | closed | off | off | on | ✳ 1 x | ○ | Normal operation, door closed and **not** locked |
| | open | off | off | off | ✳ 1 x | ○ | Normal operation, Door open |
| **Teach-in standby** (only unicode) | open | off | off | off | ✳ 3 x | ○ | Door open, unit is ready for teach-in for a new actuator(only short time after power-up) |
| **Setup** | closed | off | off | off | ✳ 1 Hz | ○ | Teach-in operation |
| | X | off | off | off | ○ | ○ | Positive acknowledgment after completion of teach-in operation (only unicode) |
| **Fault display** | X | off | off | X | ○ | ✳ | Fault on the power supply (e.g. shutdown pulse duration for pulsed power supply too long) |
| | X | off | off | off | ✳ 1 x | ✳ | Fault in the teach-in operation (only unicode) (e.g. actuator removed from the operating distance prior to the end of the teach-in operation or disabled actuator in the operating distance) |
| | X | off | off | off | ✳ 4 x | ✳ | Output error (e.g. short circuits, loss of switching ability) |
| | X | off | off | off | ✳ 5 x | ✳ | Internal fault (e.g. component fault, data error or short circuit at the outputs) |
| | X | off | off | off | X | X | Internal fault |

| Key to symbols | |
|---|---|
| ○ | LED not illuminated |
| ✳ | LED illuminated |
| ✳ 10 Hz (8 s) | LED flashes for 8 seconds at 10 Hz |
| ✳ 3 x | LED flashes three times, and this is then repeated |
| X | Any state |

After the cause has been remedied, faults can generally be reset by opening and closing the door. If the fault is still displayed afterward, briefly interrupt the power supply. Please contact the manufacturer if the fault could not be reset after restarting.

**Important!**

If you do not find the displayed device status in the System status table, this indicates an internal device fault. In this case, you should contact the manufacturer.

# Technical data

**Note!**

If a product data sheet is included with the product, the information on the data sheet applies in case of discrepancies with the operating instructions.

## Technical data for safety switch CET.-AP-...

| Parameter | Value | | | Unit |
|---|---|---|---|---|
| | min. | typ. | max. | |
| **General** | | | | |
| Material, ramp | Stainless steel | | | |
| Material, safety switch housing | Die-cast aluminum | | | |
| Installation position | Any (recommendation: switch head downward) | | | |
| Degree of protection | IP 67 (screwed tight with the related mating connector) | | | |
| Safety class | III | | | |
| Degree of contamination | 3 | | | |
| Mechanical life | 1 x $10^6$ operating cycles | | | |
| Ambient temperature at $U_B$ | -20 | - | +55 | °C |
| Actuator approach speed, max. | 20 | | | m/min |
| Locking force $F_{max}$ | 6500 | | | N |
| Locking force $F_{Zh}$ in acc. with GS-ET-19 | $F_{Zh} = F_{max}/1.3 = 5{,}000$ | | | N |
| Mass | Approx. 1.0 | | | kg |
| Degrees of freedom (actuator in recess) X, Y, Z | X and Y: ± 5; Z: ± 4 | | | mm |
| Connection type (depending on version) | 2 plug connectors M12, 5- and 8-pin; or 2 plug connectors M12, 5-pin | | | |
| Operating voltage $U_B$ (reverse polarity protected, regulated, residual ripple < 5%) [1] | 24 ± 15% (PELV) | | | V DC |
| Current consumption $I_B$ | 80 | | | mA |
| For the approval according to UL the following applies [2] | Operation only with UL class 2 power supply, or equivalent measures | | | |
| External fuse (operating voltage $U_B$) | 0.5 | - | 3 | A |
| External fuse (solenoid operating voltage $U_{CM}$) | 0.5 | - | 2 | A |
| Resilience to vibration | In acc. with EN 60947-5-2 | | | |
| EMC protection requirements | In acc. with EN IEC 60947-5-3 | | | |
| **Safety outputs OA/OB** | Semiconductor outputs (p-switching, short circuit-proof) | | | |
| - Output voltage $U_{OA}/U_{OB}$ [3]<br>HIGH $U_{OA}/U_{OB}$<br>LOW $U_{OA}/U_{OB}$ | <br>$U_B$ - 1.5<br>0 | <br>-<br>- | <br>$U_B$<br>1 | V DC |
| Switching current per safety output | 1 | - | 200 | mA |
| Utilization category acc. to EN 60947-5-2 | DC-13 24V 200mA<br>Caution: outputs must be protected with a free-wheeling diode in case of inductive loads | | | |
| Switching frequency | 0.5 | | | Hz |
| **Monitoring outputs OUT and OUT D (optional)** | (p-switching, short circuit-proof) | | | |
| Output voltage | 0.8 x $U_B$ | - | $U_B$ | V DC |
| Max. load | - | - | 50 | mA |
| **Teach-in input J or input feedback loop Y** | | | | |
| HIGH | $U_B$ - 15% | - | $U_B$ | V |
| LOW | 0 | - | 1 | |
| **Solenoid** | | | | |
| Solenoid operating voltage $U_{CM}$ (reverse polarity protected, regulated, residual ripple < 5%) [1] | DC 24 V +10%/-15% | | | |
| Current consumption solenoid $I_{CM}$ | 480 | | | mA |
| Power consumption | Max. 12 | | | W |
| Duty cycle | 100 | | | % |
| **Freely configurable LEDs [4]** | **LED 1 red, LED 2 green** | | | |
| Operating voltage | 20.4 | - | 26.4 | V DC |

| **Reliability values according to EN ISO 13849-1** | **Head downward or horizontal** | **Head upward** | |
|---|---|---|---|
| Category | 4 | 3 | |
| Performance Level (PL) | e | e | |
| $PFH_d$ | 3.1 x $10^{-9}$ / h | 4.29 x $10^{-8}$ / h | |
| Mission time | 20 | 20 | years |

1) The device tolerates voltage interruptions of up to 5 ms.
2) Not on version with connector RC18.
3) Values at a switching current of 50 mA without taking into account the cable length.
4) Can vary depending on version. See data sheet.

### Typical system times

**Ready delay:** After switching on, the unit carries out a self-test for <1 s. The system is ready for operation only after this time.

**Switch-on time of safety outputs:** The max. reaction time from the moment when the safety guard is locked to the moment when the safety outputs switch on $T_{on}$ is 400 ms.

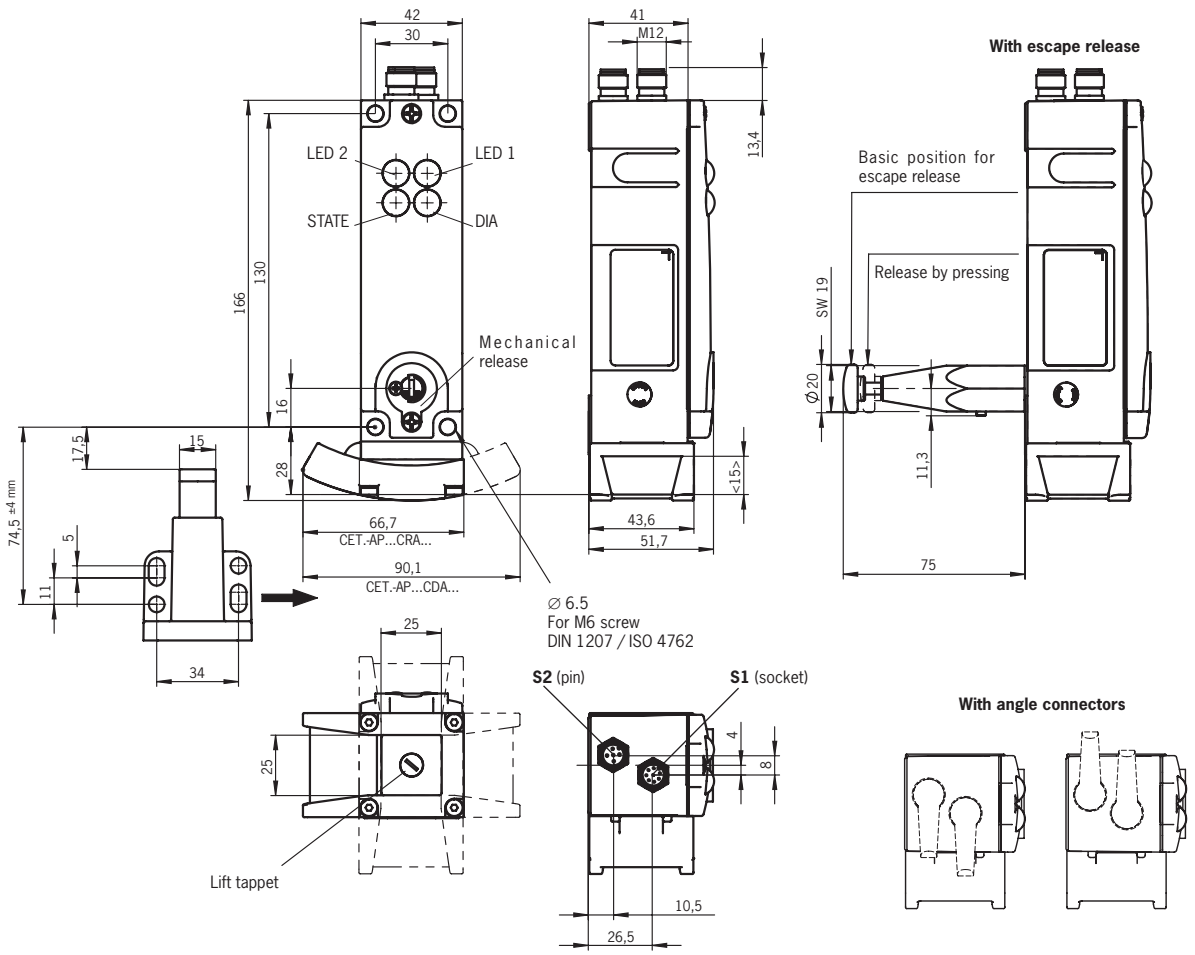
**Risk time according to EN 60947-5-3:** If an actuator moves outside the operating distance, the safety outputs OA and OB on the corresponding safety switch are deactivated after a maximum of 500 ms.

**Difference time:** The safety outputs OA and OB switch with a slight time offset. They have the same signal state at the latest after a difference time of 10 ms.

**Test pulses at the safety outputs:** The device generates its own clock signal on the output lines OA/OB. A downstream control system must tolerate these test pulses, which may have a duration of up to 0.3 ms (applies for a load with C < 30 nF and R < 20 kΩ).

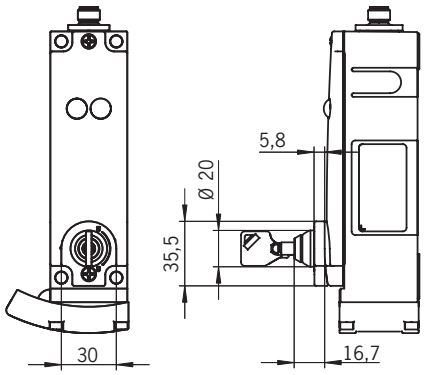
This can usually be set up in the control systems by parameter assignment. If parameter assignment is not possible for your control system or if shorter test pulses are required, please contact our support organization.

## Dimension drawing safety switch CET.-AP-...

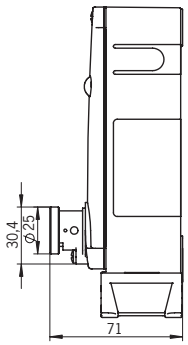



Version with plug connectors 2 x M12

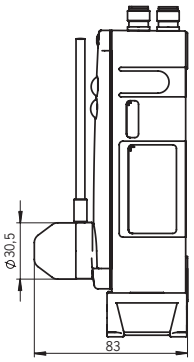
**With mechanical key release**



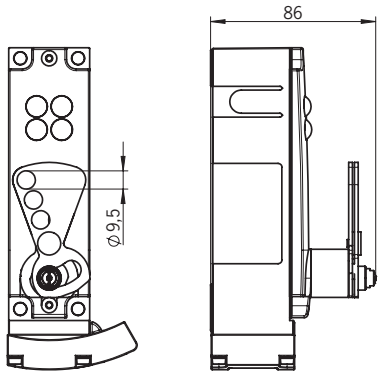

**With emergency unlocking**




**With front wire release**




**With lockout mechanism**

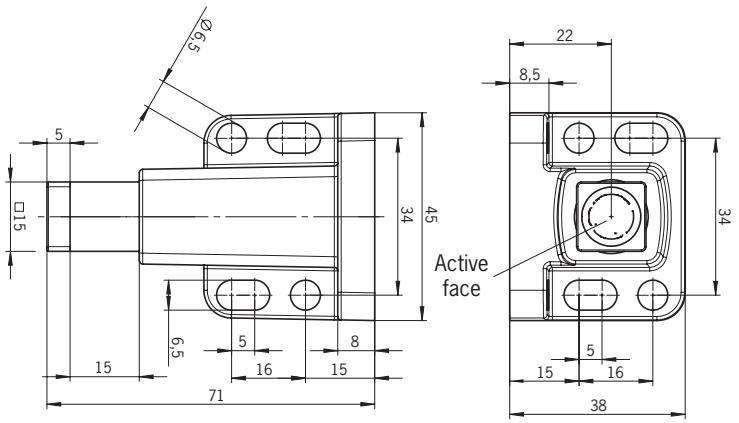


## Technical data for actuator CET-A-BWK-50X

| Parameter | Value | | | Unit |
|---|---|---|---|---|
| | min. | typ. | max. | |
| Housing material | Stainless steel | | | |
| Stroke max. | 15 | | | mm |
| Mass | 0.25 | | | kg |
| Ambient temperature | - 20 | - | + 55 | °C |
| Degree of protection | IP 67 | | | |
| Mechanical life | 1 x $10^6$ operating cycles | | | |
| Locking force, max. | 6500 | | | N |
| Installation position | Active face opposite switch head | | | |
| Power supply | Inductive via switch | | | |
| Dwell time [1] | 0.5 | - | - | s |

1) The dwell time is the time that the actuator must be inside or outside the operating distance.

### Dimension drawing actuator CET-A-BWK-50X




**Tip!**

Safety screws are included with the actuator.

# Inspection and service

**Warning!**

Loss of the safety function because of damage to the system.
In case of damage, the entire device must be replaced.
Only accessories or spare parts that can be ordered from EUCHNER may be replaced.

Regular inspection of the following is necessary to ensure trouble-free long-term operation:

- Check the switching function (see section *Functional check*)
- Check all additional functions (e.g. escape release, lockout mechanism, etc.)
- Check the secure fastening of the devices and the connections
- Check for soiling

No servicing is required, repairs to the device are only allowed to be made by the manufacturer.

**Note!**

The year of manufacture can be seen in the lower right corner of the rating plate. The current version number in the format (V X.X.X) can also be found on the device.

# Service

If service support is required, please contact:

EUCHNER GmbH + Co. KG

Kohlhammerstraße 16

D-70771 Leinfelden-Echterdingen

**Service telephone:**

+49 711 7597-500

**E-mail:**

info@euchner.de

**Internet:**

www.euchner.de

# Declaration of conformity

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CE EUCHNER

**EUCHNER GmbH + Co. KG**
Kohlhammerstraße 16
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Germany

**EG-Konformitätserklärung**
***EC-Declaration of Conformity***
***CE-Déclaration de Conformité***
***CE-Dichiarazione di conformità***
***CE-Declaración de Conformidad***

Original DE
*Translation EN*
*Traduction FR*
*Traduzione IT*
*Traducción ES*

110802-06-05/14

Die nachfolgend aufgeführten Produkte sind konform mit den Anforderungen der folgenden Richtlinien (falls zutreffend):
*The beneath listed products are in conformity with the requirements of the following directives (if applicable):*
*Les produits mentionnés ci-dessous sont conformes aux exigences imposées par les directives suivantes (si valable)*
*I prodotti sotto elencati sono conformi alle direttive sotto riportate (dove applicabili):*
*Los productos listados a continuación son conforme a los requisitos de las siguientes directivas (si fueran aplicables):*

| | | |
|---|---|---|
| I: | 2006/42/EG | Maschinenrichtlinie |
| | *2006/42/EC* | *Machinery directive* |
| | *2006/42/CE* | *Directive Machines* |
| | *2006/42/CE* | *Direttiva Macchine* |
| | *2006/42/CE* | *Directiva de máquinas* |
| II: | 2004/108/EG | EMV Richtlinie |
| | *2004/108/EC* | *EMC Directive* |
| | *2004/108/CE* | *Directive de Compatibilité électromagnétique* |
| | *2004/108/CE* | *Direttiva EMV* |
| | *2004/108/CE* | *Directiva CEM* |

Die Schutzziele der Niederspannungsrichtlinie wurden gemäß Anhang I, Nr. 1.5.1 der Maschinenrichtlinie eingehalten.
*The safety objetives of the Low-Voltage Directive comply with Annex I, No. 1.5.1 of the Machinery Directive.*
*Les objectifs de sécurité de la Directive Basse Tension sont conformes à l'annexe I, No. 1.5.1 de la Directive Machines*
*Gli obiettivi di sicurezza della Direttiva Bassa Tensione sono conformi a quanto riportato all'allegato I, No. 1.5.1 della Direttiva Macchine.*
*Los objetivos de seguridad de la Directiva de Bajo Voltaje cumplen con el Anexo I, No. 1.5.1 de la Directiva de Máquinas*

| | | |
|---|---|---|
| Folgende Normen sind angewandt: | a: | EN 60947-5-3:1999 + A1:2005 |
| *Following standards are used:* | b: | EN 1088: 1995+A2:2008 |
| *Les normes suivantes sont appliquées:* | c: | EN ISO 13849-1:2008 |
| *Vengono applicate le seguenti norme:* | d: | EN ISO 13849-2:2008 |
| *Se utilizan los siguientes estándares:* | e: | EN 50295:1999 (AS-i) |

| **Bezeichnung der Sicherheitsbauteile**<br>*Description of safety components*<br>*Description des composants sécurité*<br>*Descrizione dei componenti di sicurezza*<br>*Descripción de componentes de seguridad* | **Type**<br>*Type*<br>*Type*<br>*Tipo*<br>*Typo* | **Richtlinie**<br>*Directives*<br>*Directive*<br>*Direttiva*<br>*Directivas* | **Normen**<br>*Standards*<br>*Normes*<br>*Norme*<br>*Estándares* | **Zertifikats-Nr.**<br>*No. of certificate*<br>*Numéro du certificat*<br>*Numero del certificato*<br>*Número del certificado* |
|---|---|---|---|---|
| Sicherheitsschalter<br>*Safety Switches*<br>*Interrupteurs de sécurité*<br>*Finecorsa di sicurezza*<br>*Interruptores de seguridad* | CET1-AR...<br>CET2-AR... | I, II | a, b, c, d | UQS 117149 |
| | CET3-AP... | I, II | a, b, c, d | UQS 122248 |
| | CET3-AR... | I, II | a, b, c, d | UQS 113325 |
| | CET4-AP... | I, II | a, b, c, d | UQS 122248 |
| | CET4-AR... | I, II | a, b, c, d | UQS 113940 |
| | CET3-AS... | I, II | a, b, c, d, e | UQS 113400 |
| | CET4-AS... | I, II | a, b, c, d, e | UQS 113971 |
| Betätiger<br>*Actuator*<br>*Actionneur*<br>*Azionatore*<br>*Actuador* | CET-A-BWK... | I, II | a, b, c, d | UQS 113325 |

Benannte Stelle
*Notified Body*
*Organisme notifié*
*Sede indicata*
*Entidad citada*

NB 0035
TÜV Rheinland Industrie Service GmbH - TÜV Rheinland Group
Am Grauen Stein - 51105 Köln - Germany

Leinfelden, Mai 2014

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